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ELECTRONIC PART

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[There are no amendments to this patent.]

Claim

An electronic part having a sealed body and outer leads that project from the sealed body, characterized by the fact that recesses are formed in the sealed body to accommodate the outer leads.

Detailed explanation of the invention

Industrial application field

The present invention pertains to an electronic part. In particular, the present invention pertains to an electronic part having an outer lead that projects from a sealed body.

Prior art

Projecting outer leads are usually aligned outside the package of the sealed body for diodes, transistors, integrated circuits (IC), large-scale integrated circuits (LSI), or other semiconductor devices. These outer leads are inserted into the holes of a printed-circuit board or other printed-wire assembly produce and fixed by means of soldering, etc.

Although these outer leads are required during inspection or assembly procedures, they are not particularly needed when handling the electronic part itself. In other words, they are only necessary when inspecting the electronic part or mounting it on a printed-circuit board.

However, if many electronic parts are inserted into a hopper at the same time, the outer leads will become entangled with each other. Therefore, it is necessary to accommodate each electronic part in a single magazine or carrier for handling. As a result, the number of processing steps is increased.

Also, it is desirable to keep the assembly density of the electronic parts as low [sic; high] as possible. However, since the outer leads project outwardly, they occupy a fairly large surface area.

When an electronic part is mounted on a printed-circuit board, it is necessary to insert the external leads into the holes of the printed-circuit board. Therefore, it is necessary to form holes on the printed-circuit board, which leads to an increase in the number of manufacturing steps and cost. It is also difficult to insert the outer leads into the holes of the printed-circuit board.

Purpose of the invention

The purpose of the present invention is to provide an electronic part that can be easily handled and assembled.

The aforementioned and other purposes of the present invention as well as the characteristics of the present invention will be clarified from the following description and the attached figures.

Application Example 1

Figure 1(a) is a front view illustrating Application Example 1 of the electronic part disclosed in the present invention. Figure 1(b) is a cross section along line I-I in Figure 1(a).

In Application Example 1, the present invention is applied to a semiconductor device having a so-called dual in-line package.

In this semiconductor device, semiconductor pellets 2 are mounted on pellet mounting parts (tabs) of lead frame 1. Wires 3 are bonded between said semiconductor pellets 2 and the inner lead parts of lead frame 1.

Semiconductor pellets 2 and wires 3 are sealed in a resin-molded package 4.

Side grooves 6a are formed on both sides of the outer walls of package 4 used in this application example at positions corresponding to the outer leads 5 of lead frame 1. Bottom groove 6b connected to side grooves 6a is formed on the bottom wall. Grooves 6a, 6b are formed on the three walls. Grooves 6a, 6b are formed on the three walls [sic].

Each outer lead 5 of lead frame 1 is bent into a] shape along a groove 6 in said groove 6. The entire outer lead 5 is buried in groove 6. Outer lead 5 does not project from package 4.

In this application example, solder 7 is coated on the bottom surface of each outer lead 5 to form an electrical connection between outer lead 5 and the assembly surface. The thickness of said solder 7 is such that it projects only slightly from the bottom surface of package 4.

Consequently, according to this application example, the outer leads 5 of lead frame 1 do not project from package 4 of the semiconductor device; only solder 7 used to connect to the assembly surface projects slightly from the package. Therefore, when outer leads 5 are dipped in solder, marked, inspected, or mounted on a printed-circuit board after package 4 is sealed, the outer leads 5 of the semiconductor device will not become entangled with each other and can be handled very easily. It is possible to feed many semiconductor devices in bulk into the hopper of a parts feeder. There is no need to accommodate each semiconductor device in a single magazine, as in the conventional technology. Also, for example, when outer leads 5 are dipped in solder, since adjacent outer leads 5 are separated by the package wall surface between grooves 6a, 6b, the solder does not form a bridge between adjacent outer leads 5 so that short circuits will not occur.

Since outer leads 5 do not project from package 4, the occupied surface area can be reduced by as much as the projected part of outer leads 5 compared with the conventional technology.

When the semiconductor device of Application Example 1 is mounted on a printed-circuit board, as shown in Figures 2(a), (b), since the solder 7 on the bottom of outer lead 5 is attached to the solder layer 9 of printed-circuit board 8, there is no need to form holes for

insertion of outer leads on printed-circuit board 8, as in the conventional technology. Also, it is easy to align the positions of the outer leads and the assembly surface of the printed-circuit board.

Application Example 2

Figure 3(a) is a front view illustrating Application Example 2 of the present invention. Figure 3(b) is a cross section along line III-III.

In Application Example 2, only side grooves 6a are formed as the grooves for accommodating the outer leads of package 4. There is no groove formed on the bottom surface of the package. Also, in Application Example 2, only the lower end of each outer lead 5 projects slightly from the bottom surface of package 4, and solder 7 is coated on the bottom of the projecting part. However, outer lead 5 does not extend beyond the side surface of package 4. Also, the projection amount of outer lead 5 is minimal.

Consequently, in this application example, the semiconductor device can also be easily handled. In addition, the occupied surface area can be reduced, and the assembly operation can be facilitated.

Application Example 3

Figure 4(a) is a front view illustrating Application Example 3 of the present invention. Figure 4(b) is a cross section along line IV-IV.

In Application Example 3, only bottom groove 6b is formed as the groove for accommodating the outer leads of package 4. No groove is formed on the side surface.

As a result, in Application Example 3, outer leads 5 project partially from the side surface of package 4. However, the lower end part is accommodated in bottom groove 6b, and solder 7 projects slightly from the bottom surface of the package.

Consequently, in the case of Application Example 3, the end of each outer lead 5 does not project from package 4, and only the intermediate part projects in the form of a loop from the side wall. Therefore, outer leads 5 will not become entangled with each other and can be handled easily. Also, the occupied surface area can be reduced, and the assembly operation facilitated.

Application Example 4

Figure 5(a) is a front view illustrating Application Example 4 of the present invention. Figure 5(b) is a cross section along line V-V.

In Application Example 4, side grooves 6a and bottom groove 6b are both formed as the grooves for accommodating the outer leads. This is the same as Application Example 1 shown in

Figure 1. In this application example, however, two parts 5a, 5b of each outer lead 5 are bent into an acute angle, and only these two bent parts 5a, 5b project slightly from package 4.

Consequently, in the case of Application Example 4, since the end of each outer lead of lead frame 1 is accommodated in bottom groove 6b, outer leads 5 will not become entangled with each other. Also, the occupied surface area can be reduced, and the assembly operation facilitated.

Effect

(1) According to the present invention, when the outer leads, especially the ends, do not project from the sealed body, the outer leads can be prevented from becoming entangled with each other so that they can be easily handled to improve production efficiency.

(2) Also, when the outer leads do not project from the sealed body at all or only project partially from the sealed body, the area occupied by the electronic part can be reduced.

(3) When the [solder] is to be attached to the assembly surface, there is no need to form assembly holes in the assembly surface. In this way, it becomes easy to match the positions of the electronic part and the assembly surface.

The present inventors have explained the present invention based on the application examples described above. The present invention, however, is not limited to these application examples. Various modifications can be made as long as they do not deviate from the essence of the present invention.

For example, instead of forming grooves over the entire length of the side wall surface or bottom wall surface as recesses used for accommodating outer leads as described in Application Examples 1-4, it is also possible to form recesses that only allow accommodation of the end of an outer lead.

Industrial application field

The inventors explained the case of applying the present invention primarily to the resin-molded dual in-line package for semiconductor devices. The present invention, however, is not limited to this package. The present invention can also be applied to discrete diodes, transistors, or other types of semiconductor devices, resistors, capacitors, or other electronic parts as long as they have outer leads that project from a sealed body.

Brief description of the figures

Figure 1(a) is a front view illustrating Application Example 1 of the electronic part disclosed in the present invention.

Figure 1(b) is a cross section along line I-I in Figure 1(a).

Figure 2(a) is a front view illustrating the assembly state of the electronic part shown in Figures 1(a), (b).

Figure 2(b) is a cross section along line II-II in Figure 2(a).

Figure 3(a) is a front view illustrating Application Example 2 of the electronic part disclosed in the present invention.

Figure 3(b) is a cross section along line III-III in Figure 3(a).

Figure 4(a) is a front view illustrating Application Example 3 of the electronic parts disclosed in the present invention.

Figure 4(b) is a cross section along line IV-IV in Figure 4(a).

Figure 5(a) is a front view illustrating Application Example 4 of the electronic parts disclosed in the present invention.

Figure 5(b) is a cross section along line V-V in Figure 5(a).

1 Lead frame
2 Semiconductor pellet
3 Wire
4 Package (sealed body)
5 Outer lead
6a Side groove (recess)
6b Bottom groove (recess)
7 Solder
8 Printed-circuit board (assembly side)

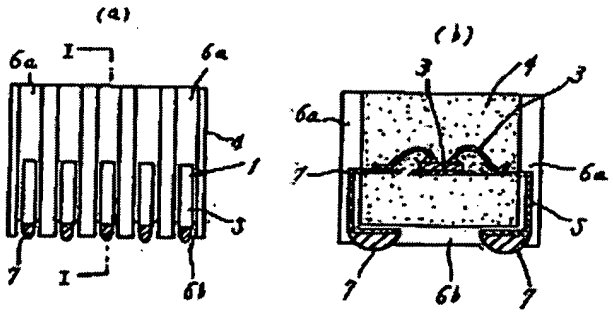

Figure 1

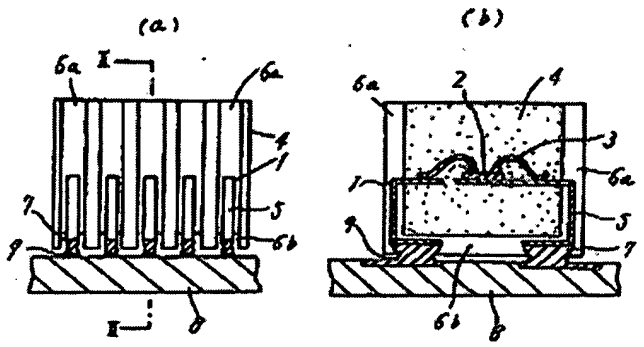

Figure 2

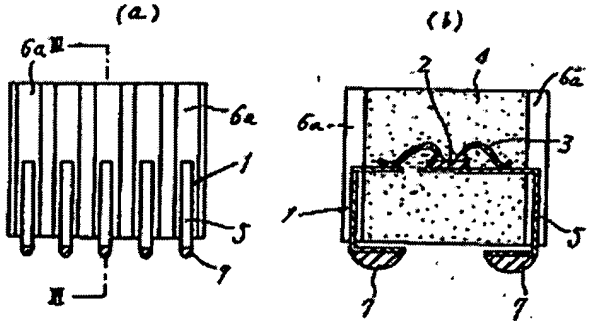

Figure 3

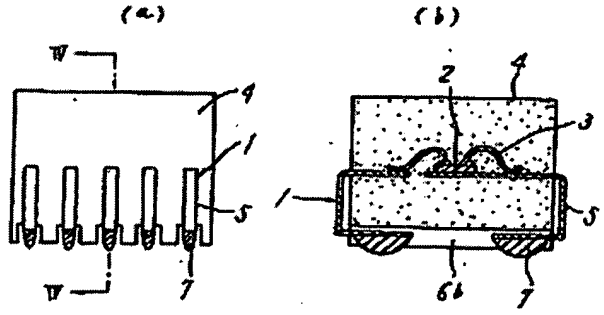

Figure 4

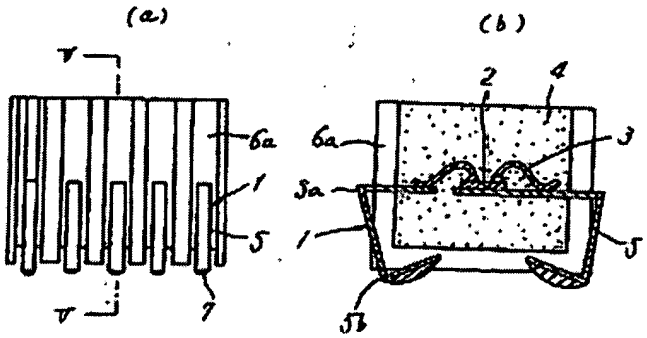

Figure 5